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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 21 JUL 2005	
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Applicant's or agent's file reference 2003UR028	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/US04/18954	International filing date (day/month/year) 15 June 2004 (15.06.2004)	Priority date (day/month/year) 02 July 2003 (02.07.2003)
International Patent Classification (IPC) or national classification and IPC IPC(7): C09K 3/00, E21B 43/28, C07C 9/00 and US Cl.: 507/90; 585/15, 950		
Applicant EXXONMOBIL UPSTREAM RESEARCH COMPANY		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 1 sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☐ Box No. VIII Certain observations on the international application

Date of submission of the demand
29 April 2005 (29.04.2005)

Date of completion of this report
13 June 2005 (13.06.2005)

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/18954

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-25 _____ as originally filed/furnished

pages* 26 _____ received by this Authority on 29 April 2005 (29.04.2005)

pages* NONE _____ received by this Authority on _____

☒ the claims:

pages 27-30 _____ as originally filed/furnished

pages* NONE _____ as amended (together with any statement) under Article 19

pages* NONE _____ received by this Authority on _____

pages* NONE _____ received by this Authority on _____

☒ the drawings:

pages 1 _____ as originally filed/furnished

pages* NONE _____ received by this Authority on _____

pages* NONE _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US04/18954**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims <u>1-25</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>15-17</u>	YES
	Claims <u>1-14 and 18-25</u>	NO
Industrial Applicability (IA)	Claims <u>1-25</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and Explanations (Rule 70.7)

Claims 1-14 and 18-23 lack an inventive step under PCT Article 33(3) as being obvious over Bakeev (US 6,117,929). Bakeev teaches a method of retarding the formation of gas hydrates using vinyl caprolactam polymers. Example 5 teaches the use of a polymer having a molecular weight of 31,250 to inhibit hydrate formation. The claims teach the use of polymers of molecular weight 500 to 2500 to inhibit formation of gas hydrates. It would be obvious to one of ordinary skill in the art to utilize a combination of polymers of different molecular weights to inhibit gas hydrates, since that is the purpose that they are individually taught useful.

Claims 1-14 and 18-25 lack an inventive step under PCT Article 33(3) as being obvious over Colle (US 6,222,083). Colle teaches a method of inhibiting hydrate formation using an N-acyldehydroalanine polymer. The polymer may be any that has a molecular weight of 1,000 to 1,000,000. It would be obvious to one of ordinary skill in the art to utilize a combination of polymers of weights between 1,000 and 1,000,000 in order to inhibit gas hydrates, since that is the purpose that they are individually taught useful.

Claims 15-17 the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the bimodal combination with the polymer taught in the claims.

Claims 1-25 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

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Table 2. Polymer Molecular Weight Distributions and Subcooling Temperatures

N-Vinylcaprolactam (VCap) Polymers

Example	Molecular Weight Distribution (Mass %)												Subcooling	
	<0.5K	0.5-1K	1-2.5K	2.5-5K	5-10K	10-20K	20-50K	50-100K	100-250K	250-500K	500-1,000K	>1,000K	@20 Hour Hold Time (°F and °C)	
Example 4 90% TR-544 + 10% GH267	29.17	24.88	24.84	7.92	4.14	2.87	2.98	1.6	1.1	0.3	0.1	0		34°F 18.9°C
Example 5B R5-772	89.8	7.96	2.2	0.04	0	0	0	0	0	0	0	0		28°F* 15.6°C
Example 5A GH 267	0.1	1.3	3.6	5.4	10.8	18.8	28	16	11.7	3.1	1.0	0.2		18°F 10°C
Example 5C TR-544	32.4	27.5	27.2	8.2	3.4	1.1	0.2	0	0	0	0	0		30°F 16.7°C
Example 5D 90% R5-722 +10% GH267	80.83	7.3	2.3	0.58	1.08	1.88	2.8	1.6	1.1	0.3	0.1	0		27°F 15°C

*Concentration 0.45 wt% and hold time 18 hours.

ATTENDED SHEET